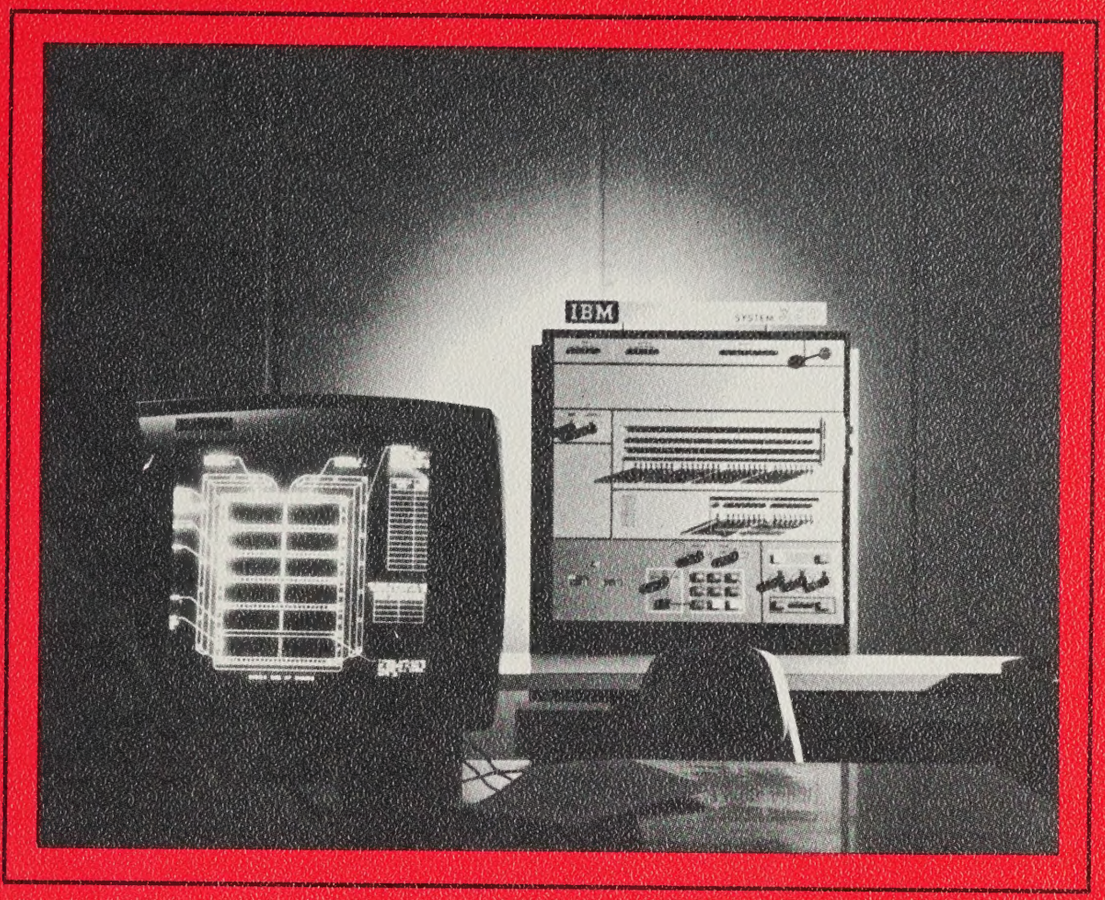
DEPT. OF EDUCATION
HISTORICAL COLLECTION



DATA PROCESSING

grade 10 - volume 2

EDUCATIONAL TELEVISION SERIES 1967-68

Educational Television Branch
ONTARIO DEPARTMENT OF EDUCATION
1670 Bayview Avenue / Toronto 17

program schedule

DATA PROCESSING

10 programs of 20 minutes each

PROGRAM NO.	CBC 9:50	CBOT 9:40	CKCO 9:20
1	Oct. 20	Oct. 16	Oct. 27
2	Oct. 27	Oct. 23	Nov. 3
3	Nov. 17	Dec. 11	Nov. 24
4	Dec. 8	Dec. 18	Dec. 15
5	Jan. 12	Jan. 8	Jan. 19
6	Feb. 2	Feb. 5	Feb. 9
7	Feb. 23	Mar. 4	Mar. 1
8	Mar. 8	Mar. 25	Mar. 15
9	Mar. 29	Apr. 8	Apr. 5
10	Apr. 26	Apr. 29	May 3

Cover illustration courtesy International Business Machines Co. Ltd.

DATA PROCESSING—Volume 2

A series of 10 programs of 20 minutes each for students in grade 10 with general interest for grades 11 and 12

This is volume 2 of a two-volume series

The first four programs were contained in volume 1

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general introduction

This series of ETV programs is a presentation of the introductory course in Data Processing, and is designed to reinforce the classroom teaching of this new and fascinating subject. While planned primarily for the grade 10 level, following closely curriculum RP-33, the series should be of interest and benefit to any grade studying data processing for the first time.

Throughout the series, emphasis has been placed on:

a. Man's need to process data (information).

b. The development of newer and faster methods as the need arises.

c. The evolution of modern data processing systems based upon the contributions of the past.

The information given in the series is intended to present those parts of the course which lend themselves to visual presentation and which would be difficult for the teacher to present without searching through vast sources of reference and visual material.

It is felt that the series will add an additional dimension to the students' understanding of data processing by presenting television visits to actual business establishments.

Many of today's great achievements, such as the space programs, would not have been possible without the assistance of modern, high-speed data processing systems. The television series will show the subject as an important preparation for future life.

program five

UNIT RECORD — PART 1

This program illustrates the unit record principle—what the punched hole will do—and introduces the fundamentals of unit record data processing.

PROGRAM CONTENT

The early developments of punched-card equipment are briefly highlighted. These include Jacquard's punched card textile loom, Hollerith's punched card system used to process the 1890 U.S. Census, and a similar system designed by Powers to process the 1910 U.S. Census. The Hollerith and Powers punched cards, commonly referred to today as the IBM and UNIVAC cards, are illustrated.

The five factors of any data processing system are related to unit record data processing systems, and appropriate symbols are used to illustrate these factors.

The preparation of a student directory illustrates the three main factors—recording (input), sorting (manipulation), and printing the directory (output). The storage factor is the card itself, and the control factor is illustrated by means of a wired control panel.

Card design is stressed and two applications—a punched card invoice and a mark sense meter card—serve to illustrate the diverse card formats that can be designed.

POINTS OF EMPHASIS

1. The unit record principle, whereby one transaction is recorded per punched card, and recorded once only, greatly increases the efficiency of data processing operations.
2. Various types of machines are used to process the punched cards in order to satisfy the requirements (factors) of any data processing system.
3. The punched card is a flexible document that can be designed to fulfill not only the input requirements of a system, but also the output requirements, as evident in the increasing popularity of punched card invoices.

SUGGESTED PRE-VIEWING ACTIVITIES

1. Review the fundamentals of unit recording data processing. Include the principles of the unit record, and the functions of the various types of unit record machines.
2. Review the symbols used in systems flow charting, and develop systems flow charts for simple applications.
3. Review the factors involved in card design.

SUGGESTED POST-VIEWING ACTIVITIES

1. Design a source document and a card layout that could be used in a student directory application.
2. Develop systems flow charts, and design source documents, card layouts, and output documents for simple student applications, i.e.—recording student locker numbers, class marks, etc.

program six

UNIT RECORD — PART 2

This program serves two functions. First, it illustrates the steps involved in processing invoicing and associated applications. Second, it points out one of the primary advantages of the unit record itself—the fact that a single transaction affects several related applications.

PROGRAM CONTENT

The series of applications described in this program belong to what is commonly called the invoicing family. In this particular system, a daily inventory check is made to determine whether sufficient stock is available to fill customer orders which are received each day. At the same time, the inventory balances are updated in order to reflect the various inventory receipts and disbursements transactions.

A combination order-invoice set is then prepared. These documents are used to pick and ship the various items ordered, to invoice the customer for all items shipped, and to provide an accounting record for reference purposes. At the same time the order-invoice set is prepared, an accounts receivable debit transaction is created to be used to update accounts receivable at a later time.

At the end of the month, the sales transaction cards are processed to prepare various sales analysis reports.

A systems flow chart for these applications is developed and illustrates the sequential operations to be performed. The applications are then performed as indicated using the unit record equipment.

POINTS OF EMPHASIS

1. A systems flow chart may appear initially to be very complicated; however, remember that it is a step-by-step procedure to follow in order to prepare a required output. There is a reason why each step must be performed as indicated. Try to determine what the reason is for each step.
2. Note that appropriate symbols are used.
3. There are more unit record installations than computer installations, but the margin is diminishing.

SUGGESTED PRE-VIEWING ACTIVITIES

1. Understand the functions of the various types of unit record equipment.
2. Develop simplified systems flow charts for the more common unit record applications.

SUGGESTED POST-VIEWING ACTIVITIES

1. Review the applications presented in this program and develop systems flow charts for inventory control, invoicing, and sales analysis.
2. Include control steps in each systems flow chart which would verify the accuracy of the output.
3. Develop a systems flow chart for a payroll application.

program seven

THE ANATOMY OF A COMPUTER

This program illustrates two physical characteristics which distinguish the electronic computer from other data processing systems. First, the electronic computer stores both instructions and data in electronic devices which permit data movement, arithmetic operations, and logic operations to be performed in millionths and even billionths of a second. Second, all the factors of a data processing system—input, storage, manipulation, output, and control—are integrated within a single unit.

PROGRAM CONTENT

The rapid development of electronic computers from the Harvard Mark I in 1944 to our present computer systems is reviewed. The two major motivating forces are the increasing demand and the many technological advances in electronics.

The five factors of any data processing system are contained within a computer system. Apart from the fact that these factors are integrated within a single system, the computer is unique among all other data processing systems in that the instructions which make up the program to be executed, are stored internally in the computer's memory. The stored program concept provides immense capacity to store instructions, rapid access time to retrieve instructions from storage, the ability to execute instructions that will change other instructions, and a logic unit which gives the impression that the computer is a rational being. *Input* devices such as card readers, punched paper tape readers, magnetic tape drives, magnetic disk drives, console typewriters, and optical scanners are described. The *control* factor is described as consisting partly of the external controls found on the control panel, but is primarily comprised of the internal circuitry required to interpret the instructions stored in memory and to execute each instruction. *Storage* is illustrated in considerable detail. Coding structures, and the difference between character and word storage are described. The *arithmetic* unit and binary arithmetic are also described. *Output* devices such as card punches, paper tape punches, magnetic tape drives, magnetic disk drives, console typewriters, and high-speed printers are illustrated.

The program concludes with a simple demonstration—the preparation of a student directory. A systems flow chart is developed to illustrate the hardware features of the computer that are required, and a procedural flow chart is developed which depicts the sequential operations to be performed in order to print the directory. The program concludes with the preparation of the student directory.

POINTS OF EMPHASIS

1. Instructions as well as data are stored in a binary code in magnetic storage devices.
2. The control unit consists primarily of the internal circuitry which translates and executes the stored instructions.
3. In a computer system, the five factors of a data processing system are integrated within a single unit.

SUGGESTED PRE-VIEWING ACTIVITIES

1. Review number systems and binary arithmetic.
2. Review BCD (Binary Coded Decimal).
3. Develop systems flow charts for computer applications.
4. Develop procedural flow charts for the computer applications above.

SUGGESTED POST-VIEWING ACTIVITIES

1. Develop a diagram to represent the relationship of the five factors of a data processing system.
2. Develop procedural flow charts depicting more difficult problems, such as:

   Select the largest of three integers per input card and write it on the printer.

   Determine the number of passes and failures, and the average mark, in a class of thirty-one students and write these three items using the printer. Each student's mark is punched in an individual card.

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program eight

COMMUNICATING WITH A COMPUTER

The purpose of this program is to demonstrate some different methods of instructing the computer in what it is to do.

PROGRAM CONTENT

A computer will do only that which it is instructed to do; however, the instructions which a computer executes must be coded in a form that the control unit within the computer system can understand. A code is necessary in order that the instructions shall take up as little storage space as possible. Also a computer operates in binary mode as a result of its electronic nature and instructions may be stored in a binary coded decimal representation or in the form of binary words, depending upon the particular computer. To further complicate matters, the instruction codes vary from copmuter to computer. Thus, the first concept to grasp when wondering how to communicate with a particular computer system, is that instructions stored in the memory of a computer must conform to the language of that *particular* computer.

There are two approaches to communicating with a computer. The first involves understanding the instruction format and codes which a particular computer uses, writing the instructions you wish the computer to execute in the computer's language, and storing these instructions in the memory unit of the computer. This can be done, but it is awkward, tedious, and very easy to make errors. A portion of this program illustrates machine language instructions.

The other programming approach is to write the instructions that you wish the computer to store in its memory for execution at a later time in a language that is easy for humans to use. This type of language is called a problem-oriented language or symbolic language, and although there are definite rules that must be observed, the objective of such languages is the simplification of the programming effort. COBOL and FORTRAN are popular problem-oriented languages. After a program is written in

a problem-oriented language, a program prepared by the computer manufacturer, called a *compiler*, is used to translate the problem-oriented language into the language of the particular machine. The machine-language program can then be read by the computer and stored in memory whenever required. Problem-oriented languages are described and sample statements are illustrated in the middle portion of the program.

The remainder of this program is devoted to simple problems and the COBOL instructions which would be required.

POINTS OF EMPHASIS

1. A computer system has a language of its own. It is very difficult for humans to use such a language.
2. Problem-oriented languages such as COBOL and FORTRAN greatly reduce the programming effort.
3. A problem-oriented language is translated into machine-language by means of a program (compiler) written by the computer manufacturer.
4. The translated program is punched into cards or written on magnetic tape or magnetic disk and may be read and stored in the computer at any time.

SUGGESTED PRE-VIEWING ACTIVITIES

1. Review BCD.
2. Review basic machine-language instructions.
3. Review concepts of problem-oriented programming languages.

SUGGESTED POST-VIEWING ACTIVITIES

1. Discuss differences between machine-languages and problem-oriented languages.
2. Develop procedural flow charts for problems which involve decision steps.

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program nine

PUTTING THE COMPUTER TO WORK

This program illustrates the steps involved in writing a program.

PROGRAM CONTENT

The major steps in writing a program to handle an hourly payroll application are illustrated in this program. First, a systems flow chart is developed to depict the various input and output files that are involved. Then a procedural flow chart is developed illustrating the sequence of operations the computer performs in order to compute the payroll data for each employee. The COBOL instructions required to perform the operations illustrated in the procedural flow chart are also described. The COBOL source program is keypunched and then compiled, creating a payroll object program. The payroll object program is read and stored in the computer's memory. The payroll data is then processed, an employee master file is updated, and cheques are written on the printer.

In order to clarify the payroll operation, a computer model is used to depict the storage of the payroll data, the arithmetic and logic operations involved, and the writing of the payroll cheques.

The program concludes with a detailed review of the payroll operation being processed on the computer system.

POINTS OF EMPHASIS

1. The output requirements of each application must be clearly defined.
2. Systems and procedural flow charts are integral aspects of any application.
3. A program, once written, should be thoroughly tested as to its completeness and logic.

SUGGESTED PRE-VIEWING ACTIVITES

1. Review general procedure to handle an hourly payroll.
2. Review functions of systems and procedural flow charts.

SUGGESTED POST-VIEWING ACTIVITIES

1. Discuss the advantages of a problem-oriented language such as COBOL.
2. Develop a systems and a procedural flow chart for an hourly payroll application.
3. Develop additional procedural steps that would be useful in proving the overall accuracy of the payroll application.

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program ten

THE CYBERNETIC AGE

This program, the last of a series of ten programs, examines some of the ways in which our lives today are affected by computers.

PROGRAM CONTENT

Cybernetics is the science of control and communication in all of its various manifestations in machines, animals, and organizations.*

By 1970, it is estimated that there will be twice as many computers installed in Canada as there were at the beginning of 1967. Computers have become a household word. People no longer have the apprehension they once had about computers taking over their jobs and watching their every move.

The uses of computers can generally be classified under one of the following—control, design, and simulation. Control applications which are illustrated include—computer control of traffic lights, rocket and satellite launchings, customer savings accounts, and MICR cheques (Magnetic Ink Character Recognition). A simulation application used by the Ontario Hydro illustrates alternative ways to route power during a black-out, and indicates the results which the real situation should produce. The increasing importance of data communication is also illustrated.

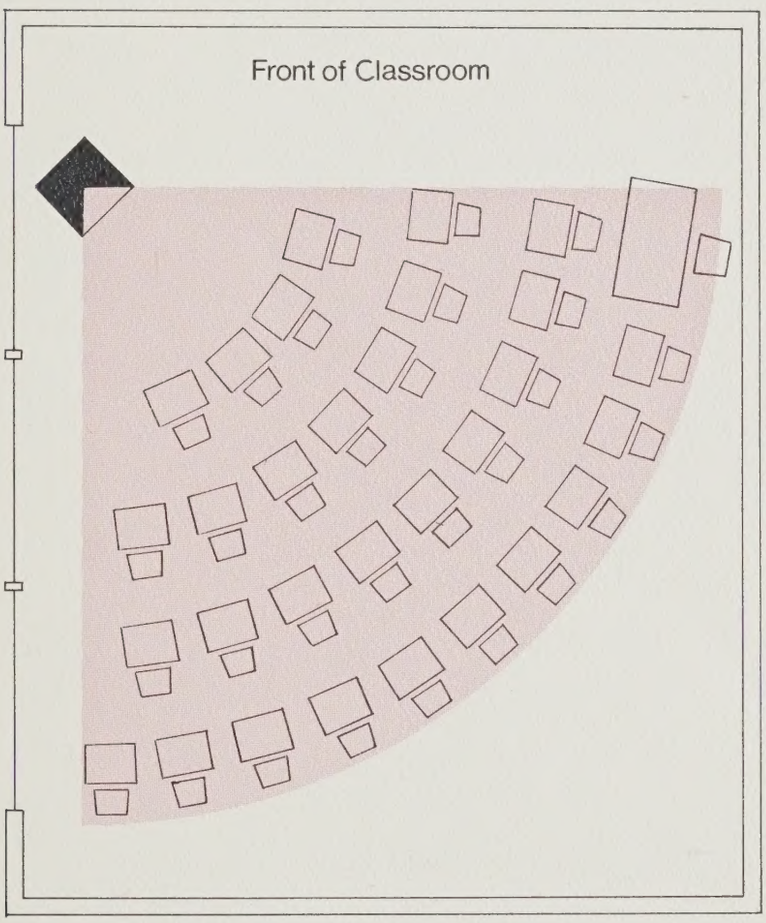
POINTS OF EMPHASIS

1. Everyone is affected by the increasing scope of computers.
2. The computer is a tool which increases man's capacity to discover, create, solve and think.
3. Through the computer, man is able to extend his power over his environment.

*McGRAW-HILL ENCYCLOPEDIA OF SCIENCE AND TECHNOLOGY, v. 3, p. 637. McGraw-Hill Inc. 1960, 1966.

FOR OPTIMUM VIEWING CONDITIONS

1. Review Teachers Guide well in advance of each telecast.
2. Have the set on and adjusted, sound off before the program begins.
3. Have suggested materials ready.
4. Be sure that you can observe both the program and your students' reactions during the telecast.
5. Assure student comfort by
   — locating the set for best viewing,
   — eliminating glare and reflection,
   — ventilating room properly,
   — placing seats within 20′ of the screen.



This diagram shows the suggested placement of the television set: